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New approach for estimating water and energy balance flux components and closure relationship

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Numerical models of heat and moisture diffusion in the soil-vegetation-atmosphere continuum are linked through the moisture flux from the surface to the atmosphere. This mass flux also represents a heat exchange as latent heat flux, coupling the water and energy balance equations. In this research a new approach is proposed for estimating the unknown parameters governing the moisture and heat diffusion equation and the closure function which links these two equations. Parameters of the system are estimated by developing objective functions that link atmospheric forcing, surface state and unknown parameters. This approach is based on conditional averaging of heat and moisture diffusion equations on land surface temperature and moisture states respectively. A single objective function is expressed that measures the moisture and temperature dependent errors solely in terms of observed and surface states. This objective function is minimized with respect to parameters to identify evaporation and drainage models and estimate the water and energy balance flux components. The uncertainty of the parameter estimates is obtained from the inverse of the Hessian of the objective function, which is an approximation of the error covariance matrix. The uncertainty analysis and analysis of the covariance approximation is used to guide the formulation of a well-posed estimation problem. The accuracy of this method is examined through the application of this method over three different field sites. The approach is scale free and thus can be applied to diverse climates and land surface conditions using remotely sensed measurements.

Biography

Leila Farhadi is an Assistant Professor at Civil and Environmental Engineering department at George Washington University. She received her Ph.D. in Water Resources and Hydrology from Massachusetts Institute of in 2012. Before joining GWU in 2013, she held a research scientist position at the Global Modeling and Assimilation Office of NASA Goddard. The main focus of his research is on land-atmosphere interaction and boundary layer processes as well as optimization techniques and parameter estimation in hydrology." Her work is presented and published in a number of reputable conferences and journals.

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